

PRELIMINARY REPORT

ON

THE DREDGING IN LAKE SUPERIOR.

NEW HAVEN, CONNECTICUT, October 9, 1871.

GENERAL: I have the honor to submit herewith a preliminary report on the dredging carried on, under your instructions, in Lake Superior, during August and the early part of September. I regret that the short time since the dredging was completed has been insufficient for more than a hasty examination and review of the materials collected, and that consequently the following report is quite imperfect as regards the microscopic species.

I wish here to acknowledge the generous assistance of Professor Verrill, who very kindly procured dredges and other apparatus for me, and who has since determined the worms and aided me by advice in many ways.

Very respectfully, your obedient servant,

SIDNEY I. SMITH.

Brevet Brigadier General C. B. COMSTOCK,

Major of Engineers, in charge U. S. Lake Survey.

REPORT.

The dredgings were all made from the steamer Search, and were carried on wholly by hand. The dredges used were like those commonly employed in marine dredging, with the addition of an inner bag of embroidery canvas, which was found necessary to retain the exceedingly fine clayey mud encountered at nearly every haul. Owing to rough weather and the employment of the steamer for other purposes, the dredgings were not so numerous as might be expected from the length of time through which they were distributed. Enough, however, was done in the deeper parts of the lake to show fully the composition of the bottom, and to indicate clearly the nature of the deep-water fauna of the lake.

The following list will show the localities at which dredgings were made, the depth, and the composition of the bottom:

Simmons's Harbor, on the north shore of the lake, about twelve and one-half miles north-northwest of Otter Island, August 9, 13 to 15 fathoms, bottom of fine sand with scattered tufts of a small alga of the genus *Cladophora*.

Five miles off Simmons's Harbor, August 11, 60 fathoms, soft bluish clay.

Among the Slate Islands, August 14, while at anchor, two hauls: First, 12 to 14 fathoms, sand with a little fine mud. Second, from the other end of the steamer, 6 to 8 fathoms, sand, gravel, and small stones, with some mud.

On a line from the Slate Islands toward Stannard Rock, August 15, four hauls were made as follows: First, about eighteen miles south of the western end of the islands, 105 fathoms, soft clay. Second, about thirty-five miles from the islands, 169 fathoms, the deepest point yet found in the lake, very soft, light-drab clay, with small pieces of rotten wood. Third, about forty miles from the islands, 116 fathoms, bottom same as in the last haul. Fourth, about fifty-seven miles from the islands, 159 fathoms, very soft clay.

On a line southeast from Passage Island, off the east end of Ile Royale, August 18, hauls were made at five points: First, about six miles out, 47 fathoms, soft reddish clay and sand. Second, about fifteen miles from Passage Island, 129 fathoms, soft clay.

Third, about twenty-nine miles from the island, 127 fathoms, bottom same as last haul. Fourth, about forty-three miles from the island, 134 fathoms, bottom as in the last two hauls. Fifth, about fourteen miles north of Keweenaw Point, 82 fathoms, two hauls, reddish clayey mud and sand.

North of Copper Harbor, August 22, dredgings were made at three different points: First, seventeen miles off, 148 fathoms, soft clay. Second, nearer the shore, 62 fathoms, soft reddish mud and sand. Third, within a quarter of a mile of the shore, 17 fathoms, sand.

Off fifty miles on a course northeast by east, one-half north of Copper Harbor, August 24, 116 fathoms, soft clay.

In Neepigon Bay, due north of St. Ignace station, and half a mile from the shore of St. Ignace Island, August 28, 32 fathoms, very soft clayey mud.

In the cove at the eastern end of St. Ignace Island, near St. Ignace station, August 29, 4 to 6 fathoms, sand with some mud, bits of wood, &c.

About three miles south of the same cove, August 29, 73 fathoms, soft clayey mud.

In a small harbor on the south side of St. Ignace Island, between the main island and a smaller one, and due south of St. Ignace station, September 4, two hauls, 8 and 10 to 13 fathoms, a little sand and mud brought up with great quantities of the same species of alga found at Simmons's Harbor, and which, according to Professor Eaton, who has kindly examined it for me, is a small densely tufted species of *Cladophora*, possibly *C. glomerata* Linn., a most variable species, but the specimens do not well correspond with authentic ones from Germany. This alga was brought up in immense quantities, the dredge being full at each haul.

On a line between Michipicoten Island and Copper Harbor, and about thirty-seven miles from the island, September 7, 147 fathoms, soft clay.

From this list it is readily seen that, in all the deeper parts of the lake, the bottom is covered with a uniform deposit of clay or clayey mud. All the soundings made by the survey show the same thing, the specimens of the bottom brought up from deep water by the lead being everywhere of the same character, varying only in color and somewhat in the amount of sand mixed with the clay. The color was not uniform, even in the same dredge-full, drab and bluish masses of the clay being frequently mixed with brown or reddish lumps. In deep water, drab and bluish were the prevailing tints, however. Water was taken from the bottom at many points, and was everywhere perfectly fresh. That from 169 fathoms gave no precipitate with nitrate of silver. The temperature, everywhere below 30 or 40 fathoms, was very uniform, varying only slightly from 39°, while at surface, during the season at which the dredging was carried on, it varied from 50° to 55°.

The fauna of the lake-bottom corresponds with these physical conditions. In the shallow waters along the shores, the fauna varies with the varying character of the bottom, while below 30 to 40 fathoms, where the deep-water fauna properly begins, the same species seem to be everywhere nearly uniformly distributed down to the deepest points. The soft clayey bottom is, however, very unfavorable to most forms of animal life, and, as we might expect, the fauna of this region is very meager. Except among the worms, it seems to have scarcely any species peculiar to it, and is characterized rather by the absence of many of the shallow-water species than by forms peculiar to itself.

In the following notes upon the species obtained, I am indebted to Professor Verrill, for the entire account of the worms.

FISHES.

Cottus Franklini Agassiz.—Several specimens were taken, in 8 to 13 fathoms, among *Cladophora*, &c., on the south side of St. Ignace.

INSECTS.

Chironomus, larvæ and pupæ.—Species of this, or of closely allied genera of small, two-winged flies, were found in nearly all the dredgings. Several quite large whitish forms, both larvæ and pupæ, were common in all the dredgings down to 32 fathoms. A minute, entirely blood-red species was found in 6 to 8 fathoms among the Slate Islands, and in 8 to 13 fathoms on the south side of St. Ignace. A slender, semi-translucent form was found in many of the dredgings from shallow water down to 147 fathoms.

An unknown dipterous larva, 4 to 6 fathoms, cove at the eastern end of St. Ignace.

Ephemeridæ.—The larva of a single species, 32 fathoms, Neepigon Bay.

Phryganeidæ.—Two species, 8 to 13 fathoms, south side of St. Ignace.

Hydrachna sp.—Taken in 4 to 6 fathoms in the cove at the eastern end of St. Ignace.

CRUSTACEA.

PODOPHTHALMIA.

Mysis relicta Lovén.—About ten years ago the Danish naturalist Lovén* described a species of *Mysis* under this name from Lakes Winer and Wetter, in Sweden. It was found in company with *Pontoporeia affinis* Lindström, *Pallasia cancelloides* (Gerstfeldt sp.), *Gammaracanthus loricatus* Bate and *Idotea entomon*, the last two being known also as marine species. Lovén describes the species of *Mysis* as closely allied to the *M. oculata* Fabricius, a marine species found on both sides of the Atlantic, and he regards its occurrence, and that of the *Pontoporeia*, as evidence that the lakes where it is found were formerly filled with salt water, that they had been cut off from the sea by the elevation of the Scandinavian peninsula, and that the differences between these species of the lakes and their allies of the neighboring ocean have been brought about by the gradual changes in the habitats of the lake species. I have compared specimens of the *Mysis* and *Pontoporeia* from Lake Wetter with those from Lake Superior, and I am unable to find any characters by which to distinguish the European from the American forms. G. O. Sars, in his great work on the fresh-water crustacea of Norway, describes this same species of *Mysis* from Lake Mjösen, where he found it in from 3 and 6 to 200 fathoms.† Sars, however, regards it as only a variety of the marine *Mysis oculata*.

In Lake Superior, the *Mysis*, was found in a large number of the dredgings. It was brought up with sand and mud from 12 to 14 fathoms among the Slate Islands, from 4 to 6 fathoms in the cove at the eastern end of St. Ignace, from 8 and 13 fathoms with *Cladophora*, &c., on the south side of St. Ignace, and from deep water, in a large proportion of the hauls, from 73 to 148 fathoms.

AMPHIPODA.

Pontoporeia affinis Lindström.—What has been said in regard to the identity of the *Mysis* from Lake Superior and the Scandinavian lakes applies equally well to this species. I can find no good differences between the Lake Wetter and the American specimens. Lovén, in the paper referred to, regards the European form as closely allied to the *Pontoporeia femorata* Kroyer from the Greenland seas; while Sars, who found it in the small lakes near Christiania, has regarded it as a variety of that species. In Lake Superior it was abundant, and occurred at every dredging, from the shallowest to the deepest.

Since the above notices of the species of *Mysis* and *Pontoporeia* were written I have received through the courtesy of Dr. Stimpson, of the Chicago Academy of Sciences, the *Mysis*, three species of Amphipoda, and the *Pisidium* dredged by him in Lake Michigan in the summer of 1870, and of which a short notice was published by Dr. Stimpson in the American Naturalist for September of that year. On comparison I find the *Mysis* and one of the species of Amphipoda from Lake Michigan of the same species as the *Mysis* and *Pontoporeia* from Lake Superior, while the other species of Amphipoda are quite different from the *Gammarus* and *Crangonyx* described beyond. Dr. Stimpson, however, regards the forms from Lake Michigan as new species, but I am not aware that he has compared them with specimens from the European lakes.

Crangonyx gracilis Smith, sp. nov.—Eyes slightly elongated, black, composed of few facets. Antennulæ slender, slightly more than half as long as the body; secondary flagellum but little longer than the basal segment of the primary. Antennæ much shorter than the antennulæ; the flagellum and peduncle of about equal length, the peduncle being a little longer than the peduncle of the antennulæ. Gnathipoda subequal in both sexes, the second pair being only slightly larger than the first; propodus in the first pair quadrate, the palmary margin transverse, nearly straight, and armed with slender spines, of which one or two at the prominent posterior angle are much larger than the others; propodus in the second pair like those of the first, but a little more elongated, and the palmary margin slightly oblique. Third, fourth, and fifth pairs of pereopoda equal in length, and the margins of their basa spinulose. Ultimate pleopoda reaching to the tips of the penultimate; the outer ramus nearly twice as long as the peduncle, and armed with slender spines; the inner ramus very minute, shorter than the width of the outer. Telson scarcely as long as the bases of the ultimate pleopoda, slightly broader than long, and the posterior margin with a triangular emargination, either side of which the extremity is truncate and armed with several spines.

The incubatory lamellæ of the female are very large, projecting much beyond the coxæ of the anterior legs, as in *C. recurvatus* Grube, (Archiv für Naturgeschichte, xxxii, p. 410, pl. 10, fig. 1.) which our species much resembles in the form of the antennulæ, antennæ, gnathopoda, &c., while it differs much in the ultimate pleopoda and in the form of the telson. Length 6 to 7 mm.

* Om nagra i Vettern och Venern fauna Crustaceer Översigt af Kongl. Vetenskaps-Akademien's Förhandlingar. Stockholm, xviii, 1861, p. 285.

† Zoölogical Record for 1867, p. 617.

Among *Cladophora*, in 8 to 13 fathoms on the south side of St. Ignace.

Gammarus lacustris Smith, sp. nov.—Eyes slightly elongated, black. Antennulæ not quite half as long as the body, and furnished with a few short hairs; first and second segments of the peduncle equal in length, third much shorter; flagellum twice as long as the peduncle. Antennæ a little shorter than the antennulæ; ultimate and penultimate segments of the peduncle equal in length, the basal segments short; flagellum considerably shorter than the peduncle. Gnathipoda about equal in size; propodus in the first pair elongated and much narrowed toward the articulation of the propodus, palmary margin slightly concave, continuous with the posterior margin, and furnished, like it, with several stout spines and numerous long hairs; dactylus slightly curved and fully half as long as the propodus; propodus in the second pair a little broader, the lateral margins nearly parallel, the palmary margin somewhat oblique, slightly concave, and furnished with a thin raised margin and several stout spines, the posterior margin without spines, but furnished with numerous fascicles of hairs. Pleon rounded above, the fourth and fifth segments each with three fascicles of two or three small spines. Third, fourth, and fifth pairs of pereopoda subequal, their basa narrow and the margins furnished with few minute spines. Rami of the posterior pair of pleopoda very slender, the edges furnished with long hairs and a few spines, inner only a little shorter than the outer. Length, 15 to 20^{mm}.

Color in life, uniform, obscure dark-brownish green, without spots or markings of any kind.

Common in company with the last species in 8 to 13 fathoms; also, at Simmons's Harbor, in 13 to 15 fathoms; and among the Slate Islands in 4 to 6 and 12 to 14 fathoms.

ISOPODA.

Asellus tenax Smith, sp. nov.—Head broad, with a large rounded sinus in the margin on each side opposite the eye, back of which the margin projects in a rounded lobe, so that the head is not narrower, posteriorly, than the anterior margin of the first segment of the pereion. Eyes small, prominent, and separated from the margin of the head by more than their diameters. Antennulæ much shorter than the peduncles of the antennæ. Antennæ half as long as the body; the flagellum longer than the peduncle. Propodus in the first pair of gnathipoda narrow and elongated, but considerably stouter in the male than in the female; dactylus more than half as long as the propodus and its palmary edge armed with acute spines, of which the distal ones are larger. The succeeding pairs of legs all similar, the carpal and propodal segments subequal in length and armed with short spines along the posterior edges; the dactyli short, armed with a few spines on the posterior margin and bi-unguiculate at tip. Pleon narrowed posteriorly, and the extremity obtusely rounded. Posterior pleopoda slender, the outer ramus only half as long as the inner. Length, 8 to 13^{mm}.

Color above dark fuscous, spotted and mottled with yellowish.

Common with the last two species, among the *Cladophora*, in 8 to 13 fathoms on the south side of St. Ignace, also in 4 to 6 fathoms at the eastern end of St. Ignace, and in 6 to 8 fathoms among the Slate Islands.

ENTOMOSTRACA.

Numerous species of entomostraca were collected at different points, but this group of crustacea has been so entirely neglected in this country that their investigation will require much careful study, and I can notice them now only in a very general way.

Of the Cladocera, species of *Daphnia* and *Lynceus* were abundant among the *Cladophora* on the south side of St. Ignace. A species of *Daphnia*, different from the one just mentioned, and a species of a closely allied genus, were taken by towing the dredge a short distance below the surface. These species were also once or twice brought up in dredging in deep water, perhaps taken in the dredge on its way up.

Ostracoda of several genera and quite a number of species were collected, some of them being found in nearly every dredging, even down to 159 fathoms.

Of Copepoda, species were obtained at nearly every haul, some of them the same species as those obtained near the surface, but many of them different, and undoubtedly from near the bottom. They were almost always abundant in the dredgings in which *Mysis* occurred, undoubtedly furnishing most of its food.

ANNELIDA, (Worms.)

LUMBRICIDÆ, (Earth-worms, &c.)

Lumbricus lacustris Verrill, sp. nov.—About 1.5 inches long, .04 in diameter. Body round; distinctly annulated. Head short, conical, obtusely pointed. Setæ spine-like, strongly curved, acute; arranged two by two, those of each pair close together. Color reddish brown.

South side of St. Ignace, among *Cladophora*, 8 to 13 fathoms, abundant.

Sænuris abyssicola Verrill, sp. nov.—Worm slender, attenuated posteriorly, about .30 inch long, .03 in diameter anteriorly. Body composed of about 25 segments; those of the posterior half elongated; those of the anterior half shorter, separated by slight constrictions. Cephalic lobe short, subconical, rounded in front. Mouth large, semicircular. Intestine slender, moniliform, containing sand. Anus terminal, with three or four slight lobes. Setæ in four fan-shaped fascicles on each segment, commencing at second segment behind the mouth. The two ventral fascicles are separated by a space equal to about twice the length of the setæ, of which there are five or six in each fascicle; the setæ are simple, acute, slightly curved, equal to about one-sixth the diameter of the body. The lateral fascicles contain three to five somewhat shorter and straighter simple setæ. One specimen appeared to have four minute ocelli upon the upper side of the head.

Off Copper Harbor, 17 fathoms, sand; off Simmons's Harbor, 60 fathoms; and on the line from the Slate Islands toward Stannard Rock, fourth haul, 159 fathoms.

Sænuris limicola Verrill, sp. nov.—Worm more slender than the preceding, attenuated posteriorly, composed of about 44 segments. Length about .33 of an inch, diameter .02. Cephalic lobe blunt, conical. Setæ in four fascicles upon each segment, six to eight in each fascicle anteriorly, four or five posteriorly. The setæ in all the fascicles are relatively long, slender, curved, and acute. Two tortuous, red blood-vessels pass along the intestine, forming a loop at each segment. Intestine moniliform.

On the line between the Slate Islands and Stannard Rock, fourth haul, 159 fathoms. *Chirodrillus*, gen. nov.—Allied to *Sænuris*, but with six fan-shaped fascicles of setæ upon each segment; two of which are ventral, two lateral, and two sub-dorsal. Setæ in the ventral and lateral fascicles five to nine, simple, acute, slender, often curved like an italic *f*; those of the upper fascicles stouter and less curved, three to six in each fascicle. Intestine wide, somewhat moniliform. Anus terminal, large.

Chirodrillus larviformis Verrill, sp. nov.—Body rather short and not very slender cylindrical, obtuse at both ends, distinctly annulated, composed of about 38 rings. Length about .30 of an inch; diameter .05. Cephalic lobe short, conical, obtuse, mouth large, semicircular beneath. Ventral fascicles of setæ near together, with about five setæ, which are rather short, simple, acute, little curved; lateral fascicles anteriorly with five or six setæ of similar form and size; upper ones similar. When preserved in alcohol the body is usually curved ventrally or in a simple coil. Color, when living, translucent, whitish; intestine slightly greenish.

Off Copper Harbor, 17 fathoms, sand; off Simmons's Harbor, 60 fathoms, clayey mud. *Chirodrillus abyssorum* Verrill, sp. nov.—Subcylindrical, thicker anteriorly, distinctly annulated, composed of about 42 segments. Length .25 of an inch; diameter about .02. Cephalic lobe short, conical, obtuse, mouth large, semicircular. Ventral fascicles with eight or nine setæ anteriorly, five or six posteriorly. The setæ are long, slender, acute, strongly curved, those on the inferior side of the fascicles nearly twice as long as those of the upper side; setæ of the lateral fascicles five or six, slender, nearly as long as those of the ventral ones, and similar in form; sub-dorsal fascicles with four or five shorter, stouter, and straighter acute setæ.

Six miles southeast of Passage Island, 47 fathoms; on line from the Slate Islands toward Stannard Rock, fourth haul, 159 fathoms.

Tubifex profundicola Verrill, sp. nov.—A rather stout species for the genus, about 1 to 1.5 inches long, .05 in diameter anteriorly, more slender posteriorly (.02 in diameter.) Cephalic lobe short, conical; one specimen apparently had two minute ocelli. Mouth large, semicircular. Intestine moniliform, with two simple red blood-vessels running along its whole length and uniting at the constrictions. In the first five or six segments there are slender vessels of nearly uniform size, which form lateral loops in each segment. Anus terminal, wide, with about ten small lobes. Setæ in four fascicles upon each segment. Those of the lateral fascicles three, anteriorly often but two, short, slightly curved, mostly with minute, forked, and hooked tips; those of the ventral series in fascicles of four to six, three or four times longer than the upper ones, considerably bent, the ends minutely hooked and forked.

Neepigon Bay, 32 fathoms.

BDELLODEA, (Leeches.)

Nepheleis ferrida Verrill, sp. nov.—Leech two or three inches long, .20 to .30 wide, elongated and slender in full extension, very little depressed, most so posteriorly; often round and tapering anteriorly. Mouth large, nearly circular, subterminal, the upper lip, in contraction, short and rounded, corrugated within the oesophagus with three conspicuous folds; eyes eight, blackish, conspicuous, two pairs, a little apart, on the first ring of the head; two pairs, wider apart and farther back, on the third ring. Color bright brick, red when living. In 8 to 13 fathoms, south side of St. Ignace.

A small specimen, probably the young of this species, taken in 13 to 15 fathoms, in Simmons's Harbor, was translucent, tinged with flesh-color, with a dark brown intestinal line posteriorly.

Nepheleis lateralis Verrill, (*Hirudo lateralis* Say.)—A small specimen, about 1 inch in

length, of an obscure liver-brown color, was taken in 6 to 8 fathoms, among the Slate Islands, which probably belongs to this species.

Ichthyobdella punctata Verrill, sp. nov.—Body, in extension slender; in the preserved specimen, about .5 of an inch long, .06 in greatest diameter, rounded, thickest posteriorly, tapering anteriorly to the anterior sucker, which is broad and thin, subcircular, about three times as wide as the neck where it is attached; ocelli four, on the upper side of the anterior sucker, the two larger, black ones, in front, and two minute ones wider apart and farther back. Posterior sucker large, rounded, or oval. Color translucent greenish, with minute black specks, arranged in transverse bands.

Among the Slate Islands, 6 to 8 fathoms.

C. C.

DENDROCELA, (Flat-worms.)

Proctotyla fluviatilis Leidy.—Numerous specimens, apparently of this species, were obtained in 8 to 13 fathoms, on the south side of St. Ignace. They were, when living, dirty white, mottled with brown.

In addition to the preceding species of worms, a few were obtained which have not yet been fully determined.

MOLLUSCA.

GASTERIPODA.

Limnæa.—A species allied to *L. disidiosa* Say, was abundant among *Cladophora* in 8 to 13 fathoms, on the south side of St. Ignace Island.

Physa heterostrophu Say. In the cove at the eastern end of St. Ignace, in 4 to 6 fathoms, and young specimens in 8 to 13 fathoms, at the locality with the *Limnæa* just mentioned.

Physa vinosa Gould.—A very young specimen, apparently of this species, in 6 to 8 fathoms, among the Slate Islands.

Planorbis parvus Say.—Common in 8 to 13 fathoms, on the south side of St. Ignace.

Valvata sincera Say, sp.—Abundant with the last species, in 8 to 13 fathoms, and also in 4 to 6 fathoms, in the cove at the eastern end of the same island.

LAMELLIBRANCHIATA.

Sphærium, sp. nov.? Among the Slate Islands, in 6 to 8 fathoms.

A single young specimen of another species of *Sphærium* was found, in 8 to 13 fathoms, on the south side of St. Ignace.

Psidium Virginicum Bourguignat. On the south side of St. Ignace, 8 to 13 fathoms.

Psidium abditum Haldeman. With the last species, in 8 to 13 fathoms, and also in 4 to 6 fathoms, in the cove at the eastern end of the same island.

Psidium compressum Prime. In the cove at the eastern end of St. Ignace, 4 to 6 fathoms.

Psidium, sp. nov. A small, semitranslucent species, the same as found by Dr. Stimpson in Lake Michigan, was brought up at nearly every dredging. It was common in the cove at the eastern end of St. Ignace, on sandy and muddy bottom, in 4 to 6 fathoms, and abundant among *Cladophora*, in 8 to 13 fathoms, on the south side of that island; among the Slate Islands, in 6 to 8 and 12 to 14 fathoms; at 13 to 15 fathoms on a sandy bottom in Simmons's Harbor; near Copper Harbor, in 17 fathoms, clear sand; in 32 fathoms, very soft clayey mud, in Neepigon Bay; off Copper Harbor, in 62 fathoms, and north of Keweenaw Point, in 82 fathoms, soft reddish clayey mud and sand; and in all the deep dredgings down to 159 fathoms. Below 100 fathoms, however, it was never abundant.

RADIATA.

Hydra carnea Agassiz. A beautiful *Hydra*, agreeing with Ayer's description of this species, was very abundant at the eastern end of St. Ignace, upon rocks along the shore and near the surface, frequently completely covering quite large surfaces, where they were protected from the direct sunlight, and was also brought up in many of the dredgings from 8 to 148 fathoms. In 32 fathoms, Neepigon Bay, and in 59 fathoms off Simmons's Harbor, it was brought up in abundance from a soft clayey bottom. In the deep dredgings, it frequently came up near the bottom of the clay in the dredge, and was evidently not caught while the dredge was near the surface.

A noticeable feature of this imperfect faunal list is the remarkable development of the *Lumbricidae*, or the family of earth-worms, which is represented by six aquatic species, all but one of them being inhabitants of deep water.

As regards the geographical distribution of species, the most important fact elicited is, undoubtedly, the identity of the species of *Mysis* and *Pontoporeia* with those of the lakes of Northern Europe.

This fact does not accord with Agassiz's* conclusions from an examination of the fishes of Lake Superior, all of which he regarded as distinct from the species of Europe, yet it is paralleled in the case of some fresh-water mollusca, while many of the terrestrial animals, and especially the plants, both land and fresh water, are common to the northern parts of both countries. Whether these forms are to be considered distinct species, or only varieties of their marine allies, is a question on which I will not now pretend to offer an opinion, as I have had no opportunity for examining authentic specimens from the North Atlantic. Whether or not they have been derived from ancient marine species left in the lake basins by the recession of the ocean, is, in either case, in the present state of our knowledge, a difficult question, and one upon which the investigation of the deep-water faunæ of the lower lakes, and especially of Lake Champlain, which we know to have been connected with the ocean at a recent geological period, and hence to have a derivative fauna, would throw much light. Among the other deep-water forms, there is no evidence whatever of derivation from marine species. The insect larvæ, all the worms, the *Pisidium*, and the *Hydra*, are most eminently fresh-water forms, while the Ostracoda and Copepoda, as groups, are inhabitants of both fresh and salt water.

The main facts of the bathymetrical distribution of the species are presented in the following table:

Names.	Depths in fathoms.					
	4-8	10-17	30-50	60-100	100-140	140-169
<i>Cottus Franklini</i>	x	x				
<i>Chironomus</i> larvæ.....	x	x	x	x	x	x
<i>Ephemeri</i> larvæ.....	x	x	x			
<i>Phryganeidæ</i> larvæ.....	x	x				
<i>Hydrachna</i>	x					
<i>Mysis relicta</i>	x	x	x	x	x	x
<i>Pontoporeia affinis</i>	x	x	x	x	x	x
<i>Crangonyx gracilis</i>	x	x				
<i>Gammarus lacustris</i>	x	x				
<i>Asellus tenax</i>	x	x				
<i>Cladocera</i>	x	x	(?)	(?)		
<i>Ostracoda</i>	x	x	x	x	x	x
<i>Copepoda</i>	x	x	x	x	x	x
<i>Lumbricus lacustris</i>	x	x				
<i>Sænuris abyssicola</i>		x		x		x
<i>Sænuris limicola</i>						x
<i>Chirodrillus larviformis</i>		x		x		
<i>Chirodrillus abyssorum</i>			x			x
<i>Tubifex profundicola</i>			x			
<i>Nepheleis fervida</i>	x	x				
<i>Nepheleis lateralis</i>	x					
<i>Ithyobdella punctata</i>	x					
<i>Proctotyla fluviatilis</i>	x	x				
<i>Limnæa</i>	x	x				
<i>Physa</i>	x					
<i>Planorbis parvus</i>	x	x				
<i>Valvata sincera</i>	x	x				
<i>Sphærium</i>	x	x				
<i>Pisidium virginicum</i>	x	x				
<i>Pisidium abditum</i>	x	x				
<i>Pisidium compressum</i>	x					
<i>Pisidium</i> , sp. nov.....	x	x	x	x	x	x
<i>Hydra carnea</i>	x	x	x	x	x	x

* Lake Superior, its physical character, vegetation, and animals, compared with those of other and similar regions.



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